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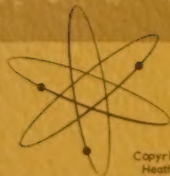
HK 122 (13)
PRICE \$2.00

HEATHKIT® ASSEMBLY MANUAL



DECADE CAPACITANCE KIT

MODEL IN-27

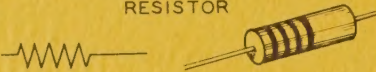
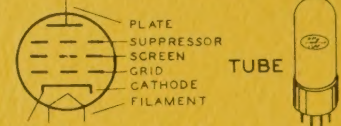
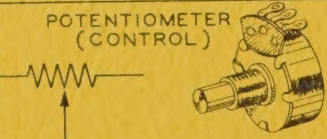
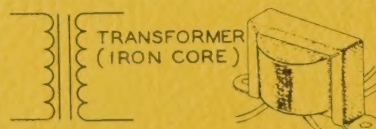
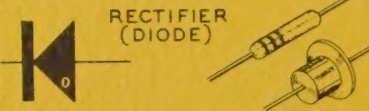
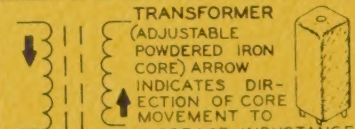
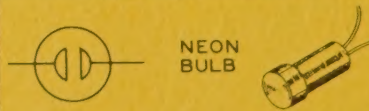
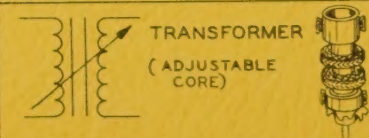
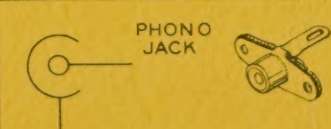
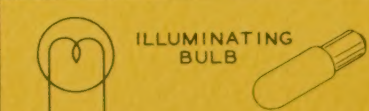


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TYPICAL COMPONENT TYPES

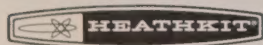
This chart is a guide to commonly used types of electronic components. The symbols and related illustrations

should prove helpful in identifying most parts and reading the schematic diagrams.

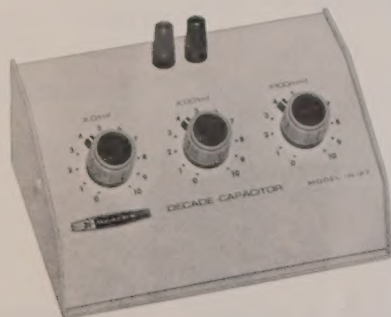
RESISTOR 	CAPACITOR 	TUBE 
POTENTIOMETER (CONTROL) 	ELECTROLYTIC CAPACITOR 	TRANSISTOR 
TRANSFORMER (IRON CORE) 	VARIABLE CAPACITOR 	RECTIFIER (DIODE) 
TRANSFORMER (ADJUSTABLE POWDERED IRON CORE) ARROW INDICATES DIR- ECTION OF CORE MOVEMENT TO INCREASE INDUCTANCE 	BATTERY 	NEON BULB 
TRANSFORMER (ADJUSTABLE CORE) 	PHONO JACK 	ILLUMINATING BULB 

Continued on Back Cover

Assembly and Operation of the



DECADE CAPACITANCE KIT MODEL IN-27



HEATH COMPANY
BENTON HARBOR, MICHIGAN

TABLE OF CONTENTS

Specifications.	2
Introduction.	2
Circuit Description.	3
Parts List.	3
Schematic. .(fold-out from page).	3
Construction Notes.	5
Step-By-Step Assembly.	6
Operation.	10
In Case Of Difficulty.	10
Replacement Parts Price List.	11

SPECIFICATIONS

Range.	100 μf to 0.111 μf in increments of 100 μf .
Voltage Rating.	350 volts DC, continuous; 500 volts DC, intermittent; 1000 volts DC instantaneous test.
Dielectric.	Silver mica.
Accuracy Of Incremental Capacity.	$\pm 1\%$.
Stray Capacitance.	10 to 15 μf at terminals.
Dimensions.	7-1/8" wide x 4" high x 5" deep.
Net Weight.	1-3/4 lbs.

The Heath Company reserves the right to discontinue instruments and to change specifications at anytime without incurring any obligation to incorporate new features in instruments previously sold.

INTRODUCTION

The IN-27 Decade Capacitance Kit was designed as an accurate laboratory-type instrument for use where a wide-range, variable capacitor is necessary. A few of its many uses include substitution for: tuned circuit elements, bridge impedances, and filter elements. For speed and convenience, it is often more desirable

to use the IN-27 to determine circuit capacitive values and, therefore, avoid involved calculations. The Heathkit Decade Resistance Kit makes an ideal companion with the IN-27 for solving resistance and capacitance networks where a large range of values is necessary.

CIRCUIT DESCRIPTION

The circuit incorporates three convenient range switches to select any capacitance from 100 $\mu\mu\text{f}$ to 0,111 μfd in 100 $\mu\mu\text{f}$ steps. The silver mica capacitors that are employed exhibit a very low dissipation factor and internal resistance. As a range switch is

rotated, it automatically selects one of, or a combination of, four silver mica capacitors and presents this capacity to the binding posts. The four capacitors of each switch are appropriately paralleled to complete the upper range of the switch.

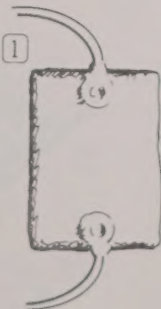
PARTS LIST

Unpack the kit carefully and check each part against the Parts List. The number in front of a part number corresponds to the picture of that part for quick and positive identification.

PART No.	PARTS Per Kit	DESCRIPTION
-------------	------------------	-------------

CAPACITORS (Silver Mica 1% 350 V)

20-13	1	.0001 μfd (100 pf)
20-14	1	.0002 μfd (200 pf)
20-15	1	.0003 μfd (300 pf)
20-16	1	.0004 μfd (400 pf)
20-17	1	.001 μfd (1000 pf)
20-18	1	.002 μfd (2000 pf)
20-19	1	.003 μfd (3000 pf)
20-20	1	.004 μfd (4000 pf)
20-21	1	.01 μfd (10,000 pf)
20-22	1	.02 μfd (20,000 pf)
20-23	1	.03 μfd (30,000 pf)
20-24	1	.04 μfd (40,000 pf)



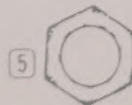
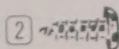
PART No.	PARTS Per Kit	DESCRIPTION
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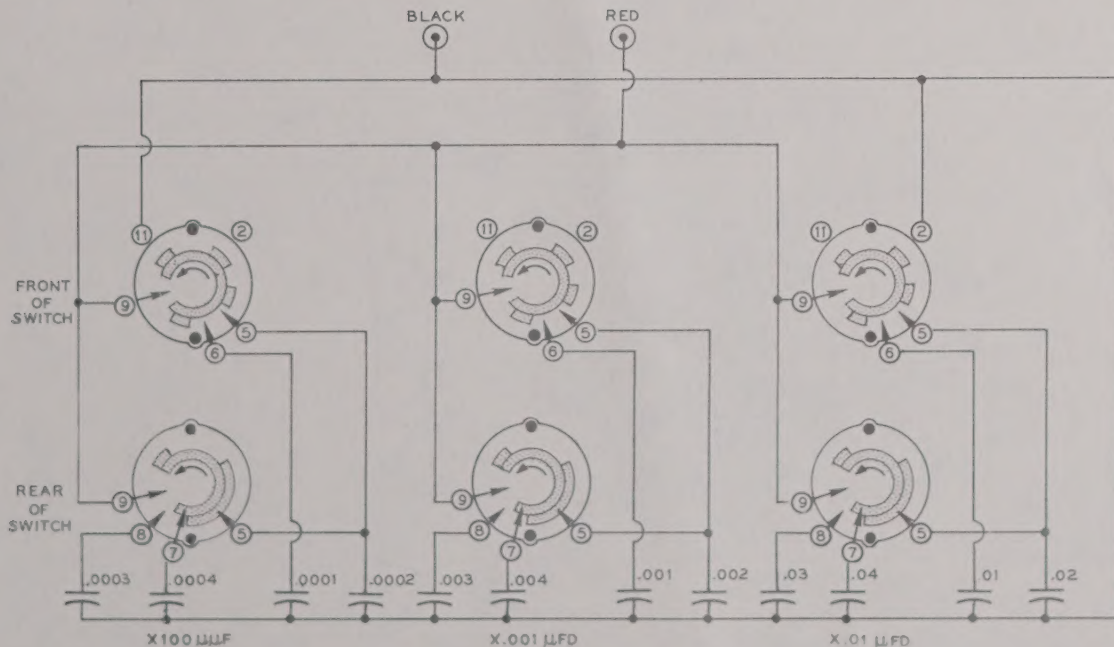
SHEET METAL PARTS

90-351-1	1	Cabinet shell
100-368-2	1	Front panel

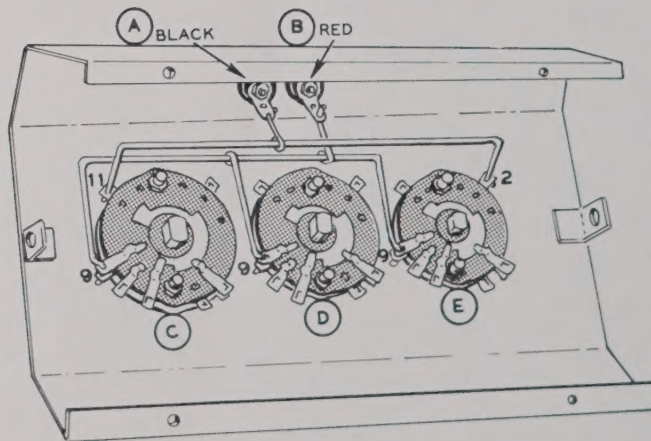
HARDWARE

2	250-8	4	#6 sheet metal screw
3	250-89	2	6-32 screw
4	252-3	4	6-32 nut
5	252-7	3	Control nut





SWITCHES ARE VIEWED FROM REAR AND FULLY COUNTERCLOCKWISE
 SCHEMATIC DIAGRAM
 MODEL IN-27



PICTORIAL 1

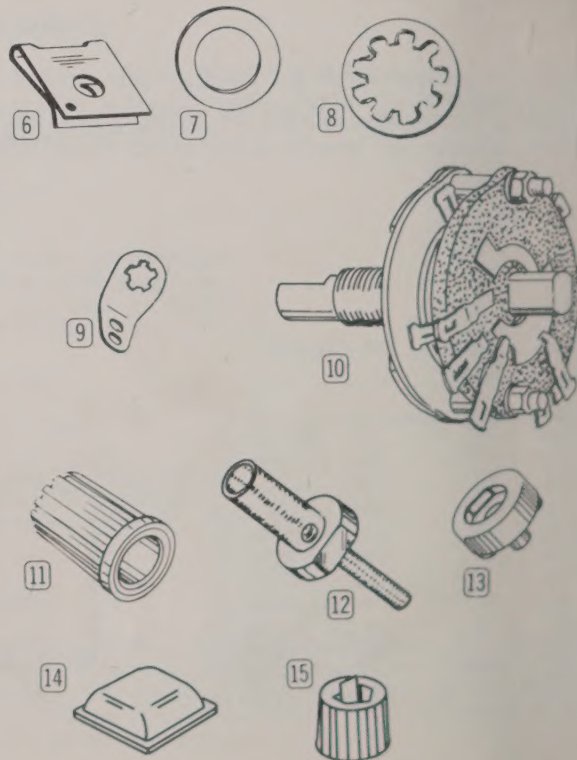
PART No.	PARTS Per Kit	DESCRIPTION
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Hardware (cont'd.)

6	252-22	2	Speednut
7	253-10	3	Control flat washer
8	254-4	3	Control lockwasher
9	259-1	2	Solder lug

MISCELLANEOUS

10	63-449	3	Range switch
11	100-16-2	1	Binding post cap, black
	100-16-18	1	Binding post cap, red
12	427-3	2	Binding post base
13	75-17	4	Binding post insulator
14	261-29	4	Rubber foot
	340-3	1	Length bare wire
	462-245	3	Knob
15	455-50	3	Knob bushing
	331-6		Solder
	391-34	1	Blue and white identification label
	597-260	1	Parts Order Form
	597-308	1	Kit Builders Guide
	595-871	1	Manual



CONSTRUCTION NOTES

The following instructions are presented in a logical step-by-step sequence to enable you to complete your kit with the least possible confusion. Be sure to read each step all the way through before beginning the specified operation. Also read several steps ahead of the actual step being performed. This will familiarize you with the requirements of the subsequent operations. When the step is completed, check it off in the space provided. This is particularly important as it may prevent errors or omissions, especially if your work is interrupted.

In general, the illustrations in this manual correspond to the actual configuration of the kit; however, in some instances the illustrations may be slightly distorted to facilitate clearly showing all of the parts.

The abbreviation "NS" indicates that a connection should not be

soldered yet as other wires will be added. When the last wire is installed, the terminal should be soldered and the abbreviation "S" is used to indicate this. Note that a number will appear after each solder instruction. This number indicates the number of leads that are supposed to be connected to the terminal in point before it is soldered. For example, if the instruction reads, "Connect a lead to lug 1 (S-2)," it will be understood that there will be two leads connected to the terminal at the time it is soldered.

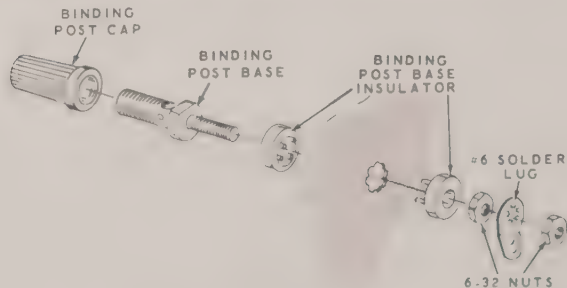
Position the work, if possible, so that gravity will help to keep the solder where you want it. The point to be soldered should be heated with the flat side of the soldering iron tip sufficiently to melt the solder. Apply only enough solder to the heated terminal to thoroughly wet the junction. Remove the solder and then the iron when a smooth soldered junction appears. Do not move the leads until the solder is solidified.

ROSIN CORE SOLDER HAS BEEN SUPPLIED WITH THIS KIT. THIS TYPE OF SOLDER MUST BE USED FOR ALL SOLDERING IN THIS KIT. ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE EQUIPMENT IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. IF ADDITIONAL SOLDER IS NEEDED, BE SURE TO PURCHASE ROSIN CORE 60/40 or 50/50 TIN-LEAD CONIENT RATIO TYPE SOLDER.

STEP-BY-STEP ASSEMBLY

Refer to Pictorial 1 (fold-out from Page 4) for the following steps.

- () Mount binding posts at A and B with black and red caps, respectively. See Detail 1A for assembly, using the binding post insulators. Note solder lug positioning as shown in Pictorial 1.



Detail 1A

- () Refer to Detail 1B and slightly spread the open end of the binding posts with a phillips screwdriver after the binding post caps have been screwed on. Tap the screwdriver lightly. This will keep the binding post caps from falling off.

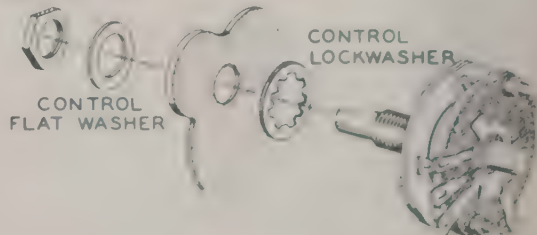


Detail 1B

Mount three range switches at the following locations. Refer to Detail 1C for assembly, and to Pictorial 1 for lug positioning.

- () C () D () E

CONTROL NUT

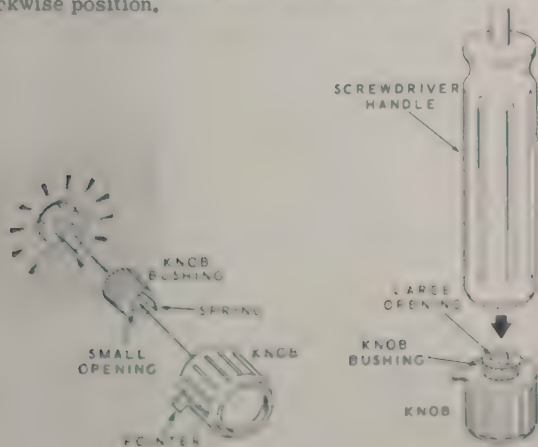


Detail 1C

The knobs supplied with this kit use knob bushings that provide permanent positive action without the use of setscrews.

In the following steps you will install a knob on each of the three switch shafts as shown in Detail 1D. Perform these steps carefully, as a knob bushing cannot be removed from a knob once it is fully inserted.

- () Push a knob bushing part way onto each of the three switch shafts. Then turn all switch shafts to their full counterclockwise position.



Detail 1D

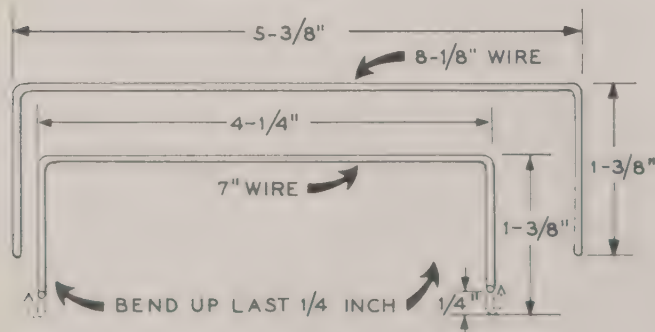
- () At one of the switch locations, line up the pointer of a knob with the full counterclockwise marking on the panel. Then press the knob slightly onto the knob bushing.
- () Turn the knob clockwise to each of the switch stop positions. Check to see that the pointer lines up with each panel marking.

NOTE: Perform the next three steps only if the pointer does not line up at each switch marking.

1. () Turn the knob pointer to the mid-position marking on the panel.
2. () Remove the knob from the bushing and turn it slightly to line up the pointer with the mid-position marking.
3. () Press the knob slightly onto the knob bushing. Then turn the knob to each switch position and recheck the pointer alignment. If more than a slight error is noticed at either end position, repeat these three steps.
- () Carefully remove the knob bushing and knob together.
- () Place the knob on a table or other hard surface, then press the knob bushing firmly into the knob. Use a towel or soft cloth on the work surface to avoid scratching the knob.
- () Press the knob and bushing firmly onto the switch shaft.
- () Repeat the above steps to install knobs at the remaining switch shafts.

Refer to Pictorial 1 for proper wire positioning in the following steps.

- () Unroll the coil of bare wire and stretch it to remove the kinks.
- () Shape a 7" bare wire to the dimensions shown in Detail 1E. Connect this wire from lug 9 of range switch C (S-1) to lug 9 of range switch E (S-1). Make sure both double lugs are soldered.



Detail 1E

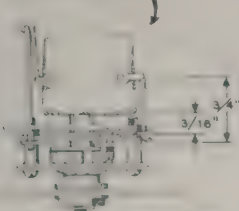
- () Connect a 1-1/2" bare wire from lug 9 of range switch E (S-1) to the middle of the 7" bare wire (S-1). Make sure the double lug is soldered.
- () Connect a 1-1/4" bare wire from the solder lug of binding post B (S-1) directly to the 7" bare wire (S-1). Crimp the end around the 7" wire as shown.
- () Shape an 8-1/8" bare wire to the dimensions shown in Detail 1E. Connect this wire from lug 11 of range switch C (S-1) to lug 2 of range switch E (S-1). Do not permit the ends of this wire to penetrate more than 1/8" into their respective switch lugs.
- () Connect a 2-1/4" bare wire from the solder lug of binding post A (S-1) directly to the 8-1/8" bare wire (S-1). Crimp the end around the 8-1/8" wire as shown.

Refer to Pictorial 2 (fold-out from Page 9) and Detail 2A (Page 9) for capacitor positioning and switch lug connections in the following steps.

Remove excess wax from the capacitor leads. Position the capacitors so that they are parallel to each other. Connect one lead of a capacitor to the indicated switch lug and the other lead to the 8-1/8" bare wire. Solder and clip off excess lead lengths as each capacitor is installed.

Detail 2A

CAPACITORS MUST CLEAR FINAL POSITION
OF BOTTOM OF CABINET.



SUGGESTED DIMENSIONS OF LEADS
AND PLACEMENT OF CAPACITORS

VALUESWITCH E, LUG

- () 20,000 pf (.02 μ fd)
- () 10,000 pf (.01 μ fd)
- () 40,000 pf (.04 μ fd)
- () 30,000 pf (.03 μ fd)

- 5 (double lug)
- 6
- 7
- 8

VALUESWITCH D, LUG

- () 2000 pf (.002 μ fd)
- () 1000 pf (.001 μ fd)
- () 4000 pf (.004 μ fd)
- () 3000 pf (.003 μ fd)

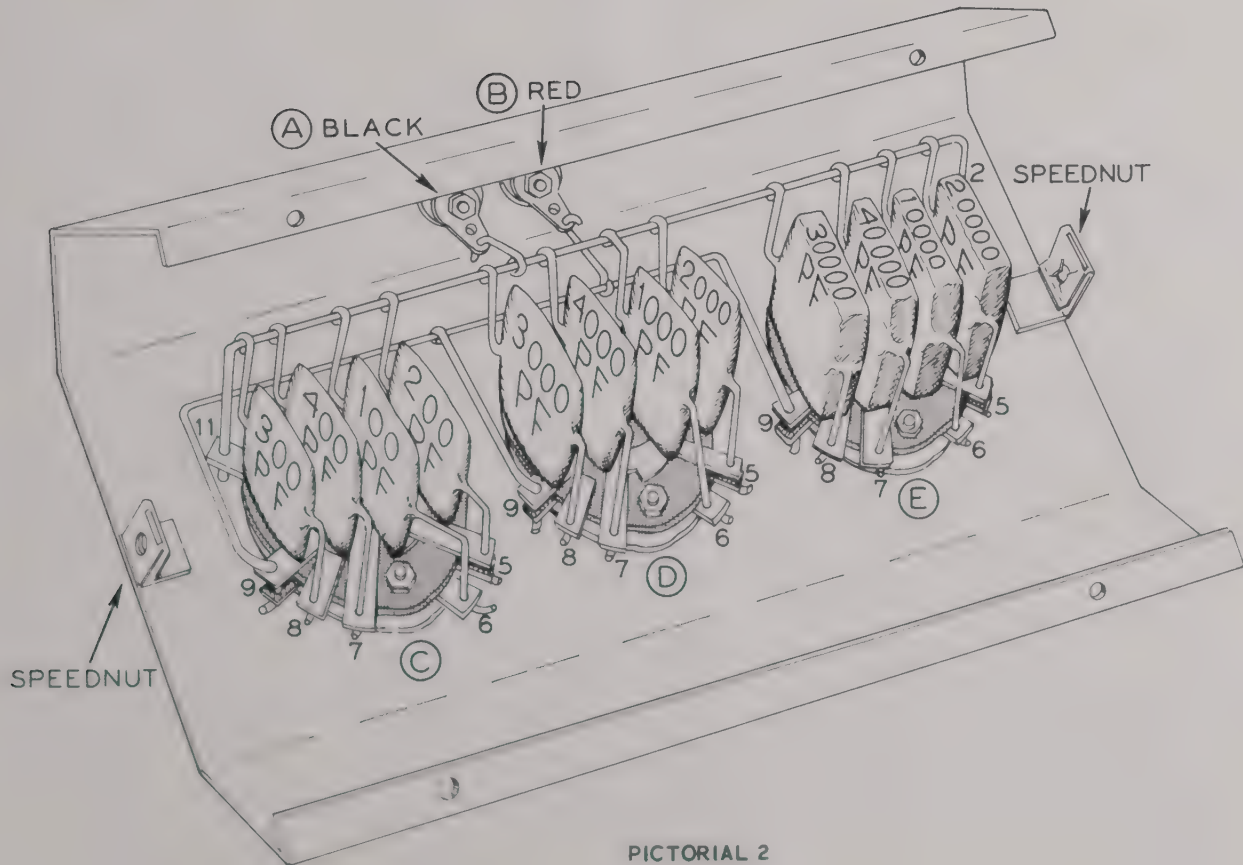
- 5 (double lug)
- 6
- 7
- 8

VALUESWITCH C, LUG

- () 200 pf (.0002 μ fd)
 - () 100 pf (.0001 μ fd)
 - () 400 pf (.0004 μ fd)
 - () 300 pf (.0003 μ fd)
- 5 (double lug)
 - 6
 - 7
 - 8

This completes the wiring. Check all the capacitors and other wiring for proper solder connections. Make sure that all of the capacitors have been connected to the proper switch lugs. Shake out any loose wire clippings.

- () Place speednuts on the I. brackets located on each end of the front panel. The flat side of the speednut should face toward the outside of the bracket.
- () Install a rubber foot at each corner on the bottom of the cabinet shell. First peel off the paper backing, then press the foot firmly into place.
- () Carefully peel away the backing paper from the blue and white identification label. Then press the label onto the inside of the cabinet shell. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.
- () Mount the cabinet shell to the front panel by inserting two #6-32 screws through the cabinet shell and into the I. brackets. Insert four #6 sheet metal screws through the cabinet shell and tighten them into the bottom of the front panel. Your IN-27 may now be placed into operation.



PICTORIAL 2

OPERATION

The Decade Capacitance Kit is very simple to operate. Just connect it to the circuit under test and adjust the range switches for the particular capacitance needed. The total value of capacitance is found by adding the settings of the three range switches. For example: if the X.01 μ fd range switch is set at 8 and the X.001 μ fd range switch at 2, with the 100 μ fd range switch at 0, the total capacitance presented at the binding posts will be .082 μ fd. It should be kept in mind that approximately 13 μ fd is always present at the binding posts and must be com-

pensated for whenever it represents a significant portion of the total capacitance involved. In applications where this must be important, be sure the black binding post is connected to the lower impedance point in the circuit under test. It is not advisable to connect the red binding post to the lower impedance point because of the variation of stray capacitance that may exist at the binding posts. Regardless of application, the voltage limitations shown in the Specifications should be observed.

IN CASE OF DIFFICULTY

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.
2. It is interesting to note that about 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered properly.
3. Check the values of the component parts. Be sure that the proper part has been wired into the circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.
4. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring beneath the panel.

Refer to the Kit Builders Guide for service and warranty information.

REPLACEMENT PARTS PRICE LIST

PART No.	PRICE Each	DESCRIPTION
CAPACITORS (Silver Mica 1% 350 V)		
20-13	.15	.0001 μ fd (100 pf)
20-14	.15	.0002 μ fd (200 pf)
20-15	.20	.0003 μ fd (300 pf)
20-16	.20	.0004 μ fd (400 pf)
20-17	.30	.001 μ fd (1000 pf)
20-18	.40	.002 μ fd (2000 pf)
20-19	.50	.003 μ fd (3000 pf)
20-20	.60	.004 μ fd (4000 pf)
20-21	1.15	.01 μ fd (10,000 pf)
20-22	2.25	.02 μ fd (20,000 pf)
20-23	3.30	.03 μ fd (30,000 pf)
20-24	4.35	.04 μ fd (40,000 pf)

SHEET METAL PARTS

30-351-1	.85	Cabinet shell
100-368-2	1.35	Front panel

HARDWARE

250-8	.05	#6 sheet metal screw
250-89	.05	6-32 screw
252-3	.05	6-32 nut
252-7	.05	Control nut
252-22	.05	Speednut

PART No.	PRICE Each	DESCRIPTION
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Hardware (cont'd.)

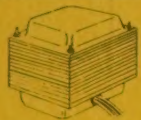
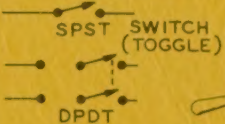
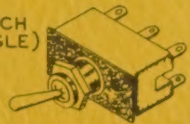
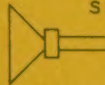
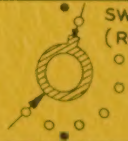
253-10	.05	Control flat washer
254-4	.05	Control lockwasher
259-1	.05	Solder lug

MISCELLANEOUS

63-449	2.05	Range switch
100-16-2	.10	Binding post cap, black
100-16-18	.10	Binding post cap, red
427-3	.15	Binding post base
75-17	.10	Binding post insulator
261-29	.10	Rubber foot
340-3	.05/ft	Bare wire
462-245	.60	Knob
455-50	.10	Knob bushing
331-6	.10	Solder
597-871	2.00	Manual

The above prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Selling prices elsewhere in U.S.A. may be slightly higher to offset transportation and local taxes. Outside the U.S.A. parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties and rates of exchange.

TYPICAL COMPONENT TYPES

 POWER TRANSFORMER 	 PHONE JACK 	 METER 
 INDUCTOR (COIL) 	 RECEPTACLE 	 SPST SWITCH (TOGGLE) DPDT 
 PIEZOELECTRIC CRYSTAL 	 SPEAKER 	 SWITCH (ROTARY) 
 BINDING POST 	 MICROPHONE 	 FUSE 
 ANTENNA GENERAL  LOOP	 EARTH GROUND  CHASSIS GROUND	CONDUCTORS  NOT CONNECTED CONNECTED SHIELDED

HEATH COMPANY

BENTON HARBOR, MICHIGAN

MP MASTER



MA23823

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM